

Areology - The Study of Mars

Objectives:

The student will have the opportunity to:

- Examine a simulated Martian surface core sample.
- Learn how an unknown core sample can be identified by matching it with a known sample.
- Discover how surface core samples can tell us about the history and make-up of Mars.
- Consume the core sample at the end of the exercise!

Mars Mission analogies:

- 1) A Mars robotic arm onboard a lander that could drill down approximately 1/2 meter into Martian surface.
- 2) A Mars long-range rover that can drill core samples in selected rocks for a sample return of Martian surface materials to Earth.

National Science Education Standards:

Standard A: Abilities necessary to do scientific inquiry

Standard G: Nature of science

National Technology Education Standards:

NT.K-12.5 Technology Research Tools

Materials needed (for each student):

- "Fun or bite size" candy bar (*Snickers, Milky Way, Mounds, Reeses Peanut Butter Cup*, etc)
- Two 3" long section of clear plastic soda straw
- Paper plate
- Plastic knife
- Graph paper or small ruler
- Wet wipes (optional for hand clean-up prior to activity, since edible material is involved.)

Procedure:

- 1) Distribute one candy bar to each student (use candy at room temperature, or a bit warmer.)
Instruct students not to show their brand to anyone else. Ask each student to unwrap their bar and record observations about its surface: color, texture, composition, etc.
- 2) Have students take a "core sample" by carefully and steadily drilling a straw into their candy bar. Then ask them to record the number and thickness of layers, as well as color and texture of layers. What are the layers made of? Any repeated layers?
- 3) Have the students use knives to cut candy in two, so the layers can be viewed more easily in a cross-section. Discuss which layers were made first. How were the layers made?
- 4) Have the students make a second core sample using the other straw. Two students then exchange core samples. Can they identify a new sample by comparing it with one that is known?
- 5) Finally, allow the students to consume the samples.

Credit: This activity is adapted from *Mission to Mars* materials from the Pacific Science Center in Seattle, WA and Adler Planetarium. Submitted to *Live from Mars* by April Whitt and Amy Singel, Adler Planetarium. Teacher's Edition created by ASU Mars K-12 Education Outreach Program.

Areology: The Study of Mars

TEACHER EDITION

Directions: You have just received a Martian surface sample. It is your job to observe and determine all the scientific information you can from this sample. You will be taking a core sample from this Martian surface sample and answering the following questions. You will then receive a second core sample to compare to the first. List anything that is similar or different between the two samples.

1. Describe the color of your Mars sample: *Have the Students observe the exact color of the surface. Is it milk chocolate color, dark chocolate, etc. Have them define in word variations to more distinctly describe what they are seeing.*
2. Describe the surface features of your Mars sample: *Is it smooth, wavy, lined, bumpy, speckled, etc.? Can they see different colors integrated into the surface?*
3. Draw a picture of any surface features you see on your Mars sample: *Have them label some of their features (optional).*
4. What is your hypothesis (science guess) about the cause of any texture that you see on your Mars sample? *If this was a Martian sample, what physical processes could have caused the textures or features you are seeing? (e.g. Water erosion (fluvial), wind erosion (aeolian), impacts, etc.)*
5. How many layers does your Martian core sample contain? *This will vary, depending on the candy bar.*
6. Draw a picture showing the layers of your Martian core sample.
7. Which layers were made first, and why? *The chocolate covering would be the surface the youngest area of deposit. The stratigraphy (the order of the layers) would grow older as they go down the straw, towards the bottom. This would generally be true, barring any unusual events, like earthquake faulting or magma (liquid rock) intrusion.*
8. Draw a picture of the second core sample showing any layers and surface features.
9. Compare the two core samples and list any similarities or differences from your first Martian core sample. *Unless the student got an Identical core sample In the exchange, there should be some change. Compare the thickness of the top layers, colors, textures, smells, number of layers, sizes of layers, softness, hardness, etc.*

10. Would a core sample from Mars be important to the study of Mars? Why? *A core sample would be very important to the study of Mars! Most of our science observations have been of surface features. To have a better understanding of the processes that formed the Martian features, probing the subsurface would be very important. There are also many unanswered questions the scientists are trying to find answers for: Is there water in the subsurface (perhaps that a human mission to Mars could access?) How many layers are there and how thick are the layers in the subsurface? Are there different rocks underground than there are on the surface of Mars? What can we tell about the climatic history of Mars from these layers (Mars '98 Mission)?*
11. Where would be the best place to study a Martian core sample...on Earth or on Mars? Why? *Actually, a case could be made for both sites ... Earth would probably have better, more sensitive science equipment available, since spacecraft equipment is somewhat limited to space/cost/sensitivity factors Studying the sample on Mars would allow the scientist to observe the actual site and surroundings of the core sample. Was this sample typical of the rest of the terrain, or an unusual occurrence? A field study could be better conducted on Mars.*
12. What would account for the samples being different if they were both from Mars? *The core samples may have been taken from different sites or different places on the planet. Remember that one sample does not necessarily translate to the whole planet being like the sample. (A good story is the "The Blind Men and the Elephant" where the blind men all feel a different part of the elephant and think they know what the whole elephant is like).*

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1) Describe the color of your Mars sample:

2) Describe the surface features of your Mars sample:

3) Draw a picture of any surface features you see on your Mars sample:

4) What is your hypothesis (science guess) about the cause of any texture that you see on your Mars sample?

5) How many layers does your Martian core sample contain?

6) Draw a picture showing the layers of your Martian core sample.

7) Which layers were made first, and why?

8) Draw a picture of the second core sample showing any layers and surface features.

9) Compare the two core samples and list any similarities or differences from your first Martian core sample.

10) Would a core sample from Mars be important to the study of Mars? Why?

11) Where would be the best place to study a Martian core sample ... on Earth or on Mars? Why?

12) What would account for the samples being different, if both come from Mars?
